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Simulation of Interaction Properties in Confined Masonry Walls at Wall-to-Tie-Column Interface

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Abstract

The confined masonry (CM) structure consists of load bearing walls strengthened with nominally reinforced concrete tie-elements at the perimeter and other key locations. The confined masonry system has evolved based on its satisfactory performance in past earthquakes and can be considered as one of the most suitable alternatives to seismically vulnerable unreinforced masonry systems due to its similar construction practice and economic feasibility. Thus, various numerical studies using finite element (FE) analysis have been performed on CM walls for a better understanding of their response under in-plane and out-of-plane loads. For reliable FE analysis, it is important to simulate the interaction behavior at the wall-to-tie-column interface in CM walls. The current method of defining the wall-to-tie column interaction for FE analysis is to consider both masonry wall and tie-column as monolith. However, this simplified assumption results in stiffer response of the CM wall. Thus, in the present study, the wall-to-tie-column interaction properties were evaluated using experimental and analytical investigation. Initially, tension and shear bond tests were conducted on sub-assemblages consisting of masonry and concrete. The tensile and shear bond properties obtained from the experiments were used to calibrate the cohesive and friction interaction properties for FE analysis. Using the iterative procedure for fine-tuning the interaction properties, a reasonable match was achieved between the experimental and numerical simulations. Finally, the interaction properties such as bond stiffness, damage initiation, and evaluation criteria were proposed for simulating the wall-to-tie-column interaction in CM walls.

Keywords: Confined masonry, Interaction properties, In-plane load response, Cohesive and friction properties, Numerical modelling